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GRAND RIVER BASIN WATER MANAGEMENT STUDY TECHNICAL REPORT SERIES

PUBLIC CONSULTATION WORKING GROUPS

TECHNICAL REPORT No. 43

GRAND RIVER IMPLEMENTATION COMMITTEE

GRAND RIVER BASIN WATER MANAGEMENT STUDY

TECHNICAL REPORT SERIES

REPORT # 43

PUBLIC CONSULTATION WORKING GROUP REPORT

PREPARED FOR THE GRAND RIVER IMPLEMENTATION COMMITTEE BY:

a) The Public Involvement Program Advisory Group

b) Public Consultation Working Groups representing the Upper, Mid Upper, Mid Lower and Lower Regions of the Grand River Basin

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ABSTRACT

This report is one of a series of technical documents prepared as part of the Grand River Basin Water Management Study for the Grand River Implementation Committee. This report was written by the Public Involvement Program Advisory Group and four Public Consultation Working Groups. The report describes the deliberations and the findings of the four working groups. The members of each working group were selected by a seven member citizen group, the Public Involvement Program Advisory Group (PIPAG). The four regional Public Consultation Working Groups, each consisting of about 15 basin residents, were formed in June 1979 to provide a major mechanism for continuous public input and to facilitate two-way interaction and dialogue between the public and study personnel. These groups performed an advisory role to the Grand River Implementation Committee, reporting administratively through the Public Consultation Subcommittee.

Questions with respect to the content of this report should be directed to the Co-Ordinator of the Grand River Basin Water Management Study, c/o Grand River Conservation Authority, 400 Clyde Road, Cambridge.

1. INTRODUCTION

1.1 BACKGROUND

The main investigative period of the Grand River Basin Study extended from 1977 to 1981. Its purpose was to define the water management problems confronting the Grand River basin, and to develop a viable set of alternative water management plans. These plans were designed to meet the following water management objectives:

1) reduce flood damage
2) provide adequate water supply
3) maintain adequate water quality

The basin study was guided by the Grand River Implementation Committee (GRIC) which is presently made up of representatives from the following ministries and agencies:

Ontario Ministry of Agriculture and Food
Ontario Ministry of the Environment
Ontario Ministry of Municipal Affairs and Housing
Ontario Ministry of Natural Resources
Grand River Conservation Authority

In order to aid the basin study in defining water resource problems, objectives and evaluating the water management plans, four regional Public Consultation Working Groups, each consisting of about 15 basin residents, were formed in June 1979. These groups reflected the diversity and interests of the upper, mid upper, mid lower, and lower portions of the watershed. Figure 1 delineates the four regions. The members were selected by a seven member citizen group, called the Public Involvement Program Advisory Group (PIPAG), formed in 1978 to advise the basin study on the development of the public information and consultation program for 1978 to 1981.

A general meeting of the Grand River Implementation Committee, Public Involvement Program Advisory Group and the working groups was held in

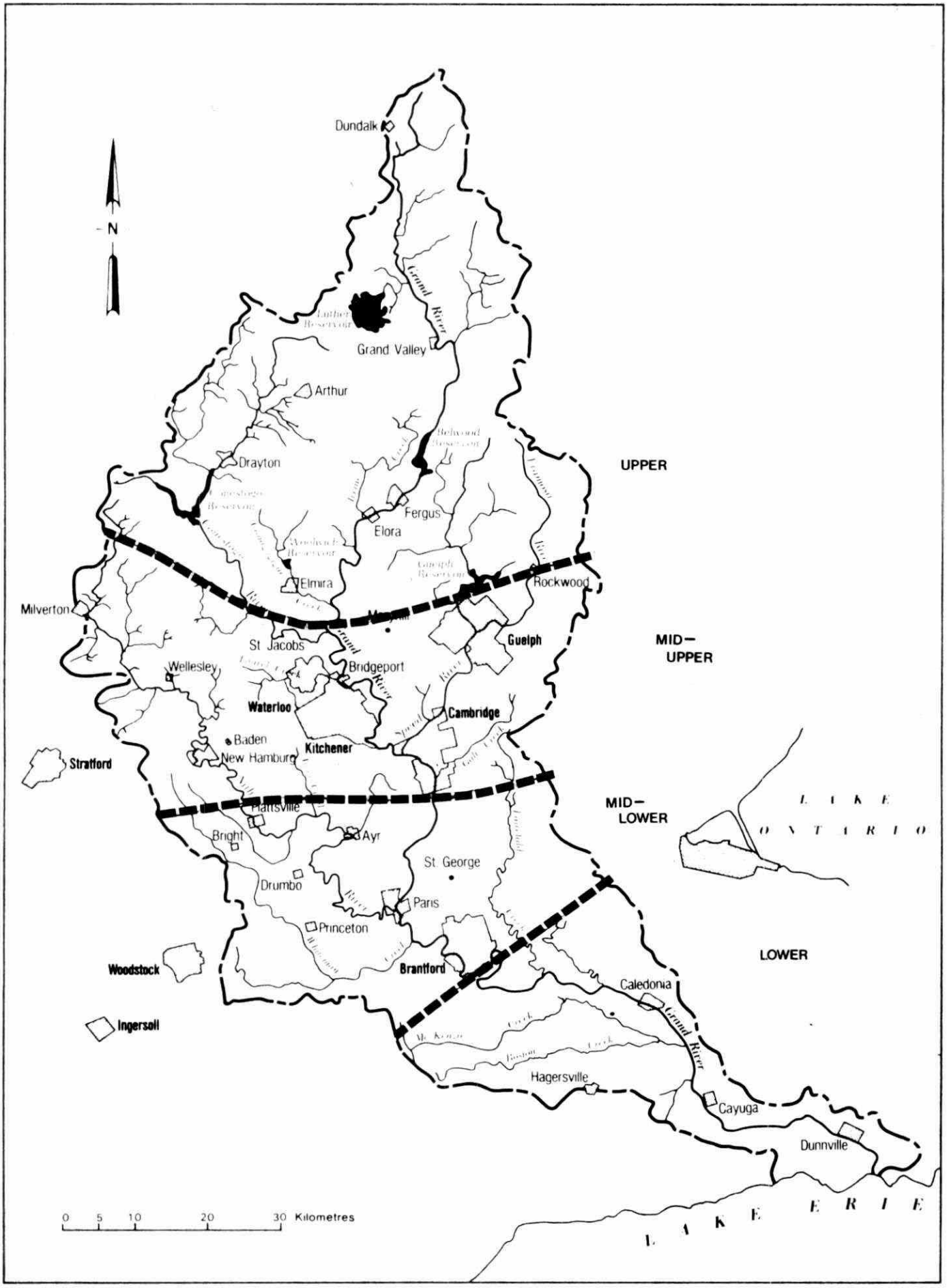


Figure I.
Public Consultation Working Groups

August 1980 to present the working group technical reports and the summary report from PIPAG to GRIC. Chapters 2 to 5 contain the four reports presented by the working groups and chapter 6 presents the PIPAG observations. The remainder of chapter 1 forms part of an introduction by PIPAG at the August 1980 meeting. A more detailed account of the public consultation process carried-out by the basin study is given in Technical Report No. 21 A Review of the Public Information, Local Involvement and Social Impact Assessment Programs - Grand River Basin Water Management Study. A description of the water management plans evaluated by the working groups is briefly described in Appendix E and in the Grand River Basin Water Management Study Report, 1982.

1.2 FORMATION OF THE PUBLIC INVOLVEMENT PROGRAM ADIVOSRY GROUP (PIPAG)

The Public Involvement Program Advisory Group (PIPAG) was formed to act as an advisory body to the Public Consultation Subcommittee of the Grand River Implementation Committee (GRIC).

Members selected to this Advisory Group reflected a diversity of interests, including agriculture, education, community services, government, industry and communication media. Other criteria used in the selection was that they be basin residents representing all geographic regions and have a genuine concern about the future of water supply, water quality and stream flow management in the Grand River Basin.

1.3 PUBLIC INVOLVEMENT PROGRAM

During earlier meetings PIPAG reviewed plans for Open Houses, Public Information Meetings, Newsletters, Fact Sheets, and overall information release and methods of communication which would best reach and involve residents of the Basin.

Attendance and participation at most Open Houses and Public Information Meetings was good. It was from these meetings that PIPAG obtained names of over 110 volunteers who would become involved in Regional Working Groups.

1.4 FORMATION OF REGIONAL WORKING GROUPS

Although initially it was thought that the Basin could be divided into three Regions, PIPAG determined that physical characteristics, geography and diverse interests made a minimum of four Regions mandatory. Then PIPAG had to deal with the composition of the working groups in order that these groups adequately reflected the diverse interest of the particular Region. Whilst a core of ten or so interests could be represented on all Regional Working Groups, the balance of each group should strengthen the particular interests of the specific Region.

From the list of volunteers PIPAG carefully slotted their selections into the previously determined categories or interests. Not all "slots" could be filled from the volunteer lists, however, PIPAG then approached groups, organizations, etc., to recommend individuals who may which to participate, and who represented the categories we had chosen.

1.5 TERMS OF REFERENCE FOR WORKING GROUPS

The terms of reference for the Working Groups were agreed upon with the Grand River Implementation Committee:

1. To provide input to the Grand River Basin Study on public concerns, issues, and opinions of water and related land management in the Grand River Basin.

2. To react and provide input to the evaluation of alternative water resource projects and management plans, as they are being developed through the Study.

3. To solicit and report on briefs from interested individuals and local interest groups.

4. To review the Public Consultation Subcommittee Report, and the technical reports from other subcommittees, and suggest any changes.

5. To prepare and present the Groups' reports to the Grand River Implementation Committee and the Public Consultation Subcommittee, specifically a summary report(s) from the Groups should cover as a minimum items 1 through 3 listed above.

6. To review the working draft of the Grand River Basin Study Report and suggest any changes.

These groups met a number of times, for lengthy periods, and have each produced a report for their Region. Their reports form chapters 2, 3, 4, and 5 of this report.

2. UPPER REGION PUBLIC CONSULTATION WORKING GROUP REPORT

2.1 UNIQUE PHYSICAL AND HUMAN CHARACTERISITCS

The Upper Region includes the head waters of the Grand River Basin from north of Kitchener in Waterloo Region through Wellington County into Dufferin County as well as a portion of Grey County.

The Upper Region of the Grand is one of the most viable agricultural areas of Ontario particularly as it relates to livestock production. Agriculture is so highly mechanized that it does not require a large work force in the townships to support the industry.

Within the Upper Region there are a number of smaller urban centres which in the past have been considered as the service centres for the surrounding farm areas. There has been some diversification of activity developed in the urban centres. Elmira and Fergus, being the larger of these towns with populations of approximately 6,000 each are industrially-based communities. This contributes significantly to the local commercial activity.

Some of the smaller centres have attracted modest manufacturing but by and large their existence still depends on being service centres for the surrounding rural areas.

A high degree of mobility is enjoyed by most people in Ontario. This, along with an excellent road system in the Upper basin accounts for many visitors from larger urban centres touring this area.

There are many natural scenic areas in the Upper Region, such as the Gorge along the Grand and Irvine Rivers in the Elora vicinity. The Eramosa River is lined with an unusually heavy stand of natural woods. Many interesting small streams found on concession roads all through the basin can be enjoyed. Ardent fishermen will vouch that they and only they know the best spots. Stretches of the Grand flow through very pronounced valleys which afford magnificent views into the river

bottom, wooded areas and far beyond to the green fertile fields. In the Luther Marsh near the head waters of the Grand River you will find one of Ontario's abundant habitats for wildlife, particularly water fowl.

There are a number of manmade attractions such as Conestogo Lake, Belwood Lake, the Quarry at Elora and Rockwood Park. A conservation park along the Grand River including part of the Gorge in Pilkington Township attracts 200,000 annual visitors.

This is a very diversified ethnic area. Interest in the Mennonite culture has brought many tourists to Woolwich Township around St. Jacobs and Elmira, where the annual maple syrup festival attracts thousands of visitors to view the local culture and handicrafts. Fergus is the home of the Highland Games. Mill Street in Elora has sponsored an interesting arts and crafts development. The Estonian annual festival presented at their children's summer camp in Pilkington Township on the Grand is an excellent presentation.

Throughout the Region are all kinds of locally sponsored events from church suppers to fiddle contests. The best agriculture produce is put on display at fall fairs along with handicrafts, while horse races and midways provide entertainment. These many forms of tourism have created a commercial need which the local urban centres can meet.

Even though the end product of the agriculture industry is largely livestock which is housed in buildings all year round, it is still essential that large rural open space be maintained. This is necessary to grow animal food stuffs, incorporate manure into the soil, and to provide for the setbacks to act as buffer zones between livestock barns and residential use.

Plotting the past 20 years of agricultural development, points out that livestock and row crops such as corn, show a steady increase in production. This trend towards more row crops has progressively moved north along the Grand River basin as new corn varieties and

farming techniques became available. From experience gained in more southerly counties it does appear that row crops naturally expand to approximately 40% of available workable land. In all likelihood this will become the pattern in the upper basin region. If this is the case, then there will be at least a 50% increase in row crops within the next few years. Whether this increase in corn production will mean a similar increase in livestock production or whether there will be more cash cropping remains to be seen.

Examining municipal planning documents reveals the fact that planning authorities do consider the retention of the predominantly rural aspect, particularly the agriculture industry, with small urban centres for servicing, to be the proper land use planning for the upper basin region.

The natural setting required for a primary food producing industry cannot be manufactured. When such a setting does exist, the decision has to be made to either maintain this setting or whether this land use is to be altered for other purposes.

2.2 CONCERNS OF THE UPPER REGION WORKING GROUP

The Basin Study prompted a great deal of interest among the residents of the Upper Region. It is in this area that most of the proposed reservoir sites are and people are naturally concerned about possible upheaval in their area. The citizens of Pilkington Township have been actively fighting the possibility of a reservoir at West Montrose for 16 years. The possibility of having the township divided into two distinct sections; the loss of a major amount of good farmland; and finally the awareness that agriculture operations would be affected in the entire upper regions above a proposed reservoir, are concerns of basin residents.

The Federation of Agriculture has had open meetings on the subject of phosphorous loadings that would be permissible if a dam was in place.

The Grand River Basin Study sponsored public forums held in different areas of the Upper region in March of 1979. At these meetings many feelings were aired. People wondered about the effects of agricultural methods on the basin waters. There were local issues raised, such as flood control in the village of Grand Valley, weed growth in that part of the Grand making it undesirable for recreation, and questions about flood plain acquisition. In Elmira there was general concern about the lowering of the water table in their area because of the municipal wells, and the level of contamination in Canagagigue Creek.

A more concise listing of priorities was derived from the Working Group at a meeting in Nov., 1979. From the beginning the concerns of the Group have been directed towards non-structural solutions. It has been felt that the preservation of natural areas such as wetlands and forested areas should be strongly considered. At these early meetings it was the feeling of the group that the operation of existing reservoirs should be reviewed regarding their role in recreation and in flood protection.

Water supply is not a problem to the residents of the upper region as far as our own supply is concerned. However, it becomes a concern when we are asked to consider the building of dams as a way of providing water for municipalities to the south of us. At this early meeting it was felt that a closer examination of water usage by the residents of Kitchener-Waterloo should be undertaken.

2.3 WATER MANAGEMENT OBJECTIVES

At the January 30, 1980 meeting of the Upper Region Working Group, Water Management Objectives of particular importance to the residents of the upper basin were established. The objectives were categorized into three sections: Flood Damage Reduction, Water Supply and Water Quality. Each objective was prioritized as High, Medium or Low (H, M or L) from the point of view of upper region residents. The following sections outline the Water Management Objectives.

2.3.1 Flood Damage Reduction

The Upper Region Group has strong feelings on flood damage reduction and accordingly has ranked all objectives in this category as high.

2.3.2 Contol High Flows

Recognizing that increased urban or rural development in the basin will cause higher peak runoff flows and in view of the existing structures encroaching on the floodway of the river it is important to control high flows.

2.3.3 Minimize Annual Damages Urban and Rural

Associated with the control of high flows is the objective of minimizing annual damages along the basin watercourses. The importance of water management projects can be evaluated objectively knowing annual damages.

2.3.4 Preserve Existing Flow Regime (High and Low)

Although conflicting somewhat with objective 3.1.1 it is important to minimize the impact that man has on the basin in order to preserve natural aesthetics and features of the watershed.

2.3.5 Assess Causes and Extent of Floods

To better understand the processes of the basin and to achieve effective water management plans it is very important to fully understand the causes and extent of high flows in the basin.

2.3.6 Manage Flood Plain Use

Flood damage reduction can only be effective if agencies with jurisdiction have organized procedures for controlling flood plain use.

2.3.7 Awareness Program (Warning System)

Further protection from high flows beyond structural measures and management plans can be achieved by implementing or maintaining communication practices in the watershed.

2.3.8 Minimize Social and Environmental Effects of Flood Control Projects

This objective covers two of the "intangible" implications of water management projects and must be included as a facet in the development of the basin plans.

2.3.9 Cost - Benefit

Having established and collected all data bases for the watershed the analysis of management plans can be objectively evaluated using cost-benefit techniques.

2.3.10 Review and Update Legislation

In view of the increasing interaction of all sectors of the basin, legislation becomes an important factor in protecting the watercourses from degradation, and protecting the rights of residents in the watershed. Legislation review must be an on-going process.

2.4 WATER SUPPLY

Two basic objectives were established for water supply. The first was the examination of variation in water needs. The second was to provide an adequate supply. The second objective was further divided into two sections; local and basin. Local objectives were established from the point of view of a resident of the upper region whereas basin objectives were generated from the point of view of a resident of the Grand River Basin.

An analysis of the variation in water needs will illustrate the proportions of water required for different uses. Therefore, the priorities shown are usually highest for the largest consumer sector. The objective of providing an adequate supply varies in priority in relation to the importance the group has placed on each consuming sector from the two vantage points.

2.4.1 Examination of the Variation in Water Needs

By examining the variation in water needs within the basin, a complete understanding of water supply requirements is generated. Due to the variation and the magnitude of water supply needs and the different priorities associated with each, the following needs and their associated priorities are given as follows:

MUNICIPAL:
Residential - high priority
Industrial - high priority
Commercial & Institutional - medium priority

RURAL:
Domestic - medium priority
Livestock - high priority
Irrigation - low priority

RECREATIONAL - low priority

2.4.2 Provide Adequate Supply for Local Needs

From the point of view of an upper region resident the following water supply requirements are given the following priority:

MUNICIPAL:
Residential - low priority
Industrial - medium priority
Commercial & Institutional - low priority

RURAL:
Domestic - low priority
Livestock - low priority
Irrigation - low priority*

*Although irrigation is rated low in priority, the group feels that irrigation may play a more important role in agricultural practices in the future.

RECREATIONAL - low priority

2.4.3 Provide an Adequate Supply for Basin Needs

From the point of view of a basin resident the priority for the following objectives is given:

MUNICIPAL:
Residential - high priority
Industrial - high priority
Commercial & Institutional - medium priority

RURAL:
Domestic - medium priority
Livestock - high priority
Irrigation - low priority

RECREATIONAL - low priority

2.5 WATER QUALITY

A brief description of water quality objectives and the priorities established by the Upper Working Group are detailed in this section. The first three objectives relate to establishing background information. The remaining objectives are overall Water Management Plan Objectives. An overall objective of the group is to at least

maintain the current quality of water. It would not be acceptable to have a lesser quality even in the short term.

2.5.1 Determine Effect of Population Trends on Quality

In order to understand the present status of water quality in the Grand River Basin, the Upper Working Group feels that as a high priority the historical pattern of population trends and degradation of water quality should be established.

2.5.2 Determine Effect of Agriculture on Water Quality

As increased population affects urban runoff quality, in a similar fashion different agricultural practices established over the years have had a marked effect on water quality. It is important to recognize the historical pattern of agricultural development and water quality degradation. This objective is given a high priority.

2.5.3 Determine Effect of Urban Waste Management on Water Quality

In the past decade, man has recognized that environmental problems have been created by the nature of his growth and industrial development. To combat these impacts waste management programs have been established. Before suggesting that these waste management practices should continue into the future and be implemented to a greater extent in the Grand River Basin it is important to know whether or not waste management practices have been effective in abating water quality degradation. This objective is given a high priority.

2.5.4 Maintain Quality for Fish

The improvement or maintenance of water quality in fish habitats should be included as a part of the Water Management Plan. This objective is given a low priority.

2.5.5 Maintain Quality for Swimming

Maintenance or improvement of water quality for water contact sports should also be a component of the Water Management Plan selected for the Grand River Basin. This objective is given a low priority.

2.5.6 Use Good Water Only Where Required

Various types of water demands exist in the basin. Often water of better quality than actually required is used because of convenience. Guidelines for the use of waters of varying qualities could be established to ease the demand on the drinking water supply. This objective is given a high priority.

2.5.7 Maintain Land Use Practices that Improve Water Quality

Recently, land use practices have been regulated carefully by municipalities and provincial agencies to enhance water quality of nearby streams. These efforts are considered worthwhile and the objective therefore is ranked highly.

2.5.8 Maintain Water Quality to M.O.E. Standard for Human Consumption

In the past, the OWRC and the MOE have established water quality guidelines which have insured that Ontarians and in particular residents of the Grand River Basin enjoy the benefits of good quality drinking water. Therefore the objective of maintaining these water quality criteria is considered equally as important and the objective is ranked highly.

2.6 KEY CRITERIA USED IN PLAN SELECTION

2.6.1 Cost and Effectiveness

Spending the taxpayers money is something that all the people in our group are aware of, but if the expense produces a solution that will

be effective in the area that we want it to be then we are willing to consider it. An example of this is the project of "Channelization and Dyking" - although initially a very costly project - its effectiveness in flood damage reduction (96%) would seem to make it worthwhile.

2.6.2 Agricultural Land Removed from Production or Restricted in Any Way by Plan Implementation

This goes back to one of the very initial concerns - that if a large area of standing water was to be in this area it would put strict controls on fertilizer usage and row crop practices. The importance of open lands for the growth of food stuffs cannot be over emphasized.

2.6.3 Environmental and Aesthetic Considerations

2.6.3.1 Water Quality

The group was concerned that any reservoir in the watershed would result in a long term deterioration of water quality downstream. The removal of a length of open river would contribute to this condition. Specific concerns include level of nitrates, sediment production, suspended solids and dramatic decreases in dissolved oxygen as a result of deterioration of debris (stumps).

2.6.3.2 Fish and Wildlife

A reservoir tends to have a negative effect on the natural flow or migration of fish and wildlife.

2.6.4 Disruption of People

Any plan that is implemented should have as little effect as possible on people, their homes and their communities. Any water management plan that would affect the potential growth of agriculture would lead to dislocations of people.

2.6.5 Permanence and Long Term Acceptability of Projects and Plans

The group assessed plans in terms of the future - how long would this plan be good for - would it cause some protection to people of the future.

2.6.6 Water Management Plans

The Upper Region Working Group favoured the proposal 1F with the following addition: planned flood plain acquisition.

Channelization and dyking protect areas that are prone to flood damage but we feel that a planned flood plain acquisition of riverbank areas - wetlands, grassed areas, properties not protected by dykes is an essential part of any plan. We believe that this type of flood plain acquisition would cost much less than the amount projected in plan 1E and would also serve to meet our objectives of retention of natural areas.

Plan 1F includes:

Water Quality	Water Supply	Flood Damage Reduction
a) Sewage treatment (conventional adv. & tertiary)	a) Ground water sources b) River (recharge, infiltration) c) Water conservation	a) Channelization dyking

Plan 1F was favoured for the following reasons:

2.6.6.1 Channelization and Dyking

Although costly, the flood damage reduction provided is considered a high priority.

2.6.6.2 Water Conservation and Water Supply

Implementation of water conservation techniques in the urban areas was deemed as very important in any water management plan. More realistic rates based on a charge for use would force urban dwellers to water conservation. A combination of water management practices should allow the extended use of river and ground water supplies.

Based on figures available to us it appears that these supplies will be satisfactory until 2031. Beyond that we would expect that water from the Great Lakes may have to be utilized.

2.6.6.3 Water Quality

The degree of sewage treatment required to produce a D.O. level of 4 mg/L in the Grand River was also felt to be essential to a good water management plan.

2.7 SUMMARY AND RECOMMENDATIONS

The upper region of the Grand River Basin is primarily an agriculturally based area. Through co-operation on the part of those involved we can hope to preserve a good quality of water. The farmer needs to be continually educated in the proper use of fertilizers, the importance of crop rotation and of good manure storage and spreading practices. The operator who is blantantly contaminating water courses should be stopped. People will have to be made to realize that even though they do not live right on the banks of the river, their methods do have an effect.

We again feel the importance of lands being allowed to stay as forested areas, as wetlands or as grassed strips but to do this the farmer will need an incentive. To have a piece of land in its natural state represents a yearly loss of potential income. It is in this area that a planned program of acquisition would be essential.

Each of the regions along the Grand has its own particular needs, and had developed its own strengths. Each region should be encouraged to build on these strengths to the extent that its natural resources will permit, so as to make its maximum contribution to the larger community all along the Grand River. It is desirable that regions can develop their own resources in such a way as to complement each other rather than to be in competition for the available resources throughout the entire basin.

The resources that the upper basin region can further develop and share with the larger urban centres are an abundance of food and open space for passive recreation. The larger urban centres will require these resources from us on an increasing basis.

The people in the upper basin do have their future at stake in their region where they live and work.

3. MID UPPER REGION PUBLIC CONSULTATION WORKING GROUP REPORT

3. MID UPPER REGION PUBLIC CONSULTATION WORKING GROUP REPORT

3.1 CONTEXT

The Mid Upper Grand River area is a microcosm of the entire watershed. The area encompases some of the best farmland in Ontario, remnant natural areas, sand and gravel resources, as well as the urban industrial centres of Kitchener, Waterloo, Cambridge and Guelph and other smaller service settlements. The diversity of the area, however, results in competing uses and objectives for the same resource - the Grand River and its tributaries.

In the Mid Upper area, the Grand River is used as a landscape resource, recreation resource and a source of water supply. It is also used as a storm sewer and the receiving stream for treated urban sewage. It is often viewed as an asset but during times of flooding it is also viewed as a threat to life and property. The above uses are not always compatible or complementary and establishing priorities is further complicated by conflicting objectives of different users and pressure for change to accommodate population growth and technological advances.

Population growth in Ontario has slowed considerably during the late 1970's. In fact, Ontario experienced an unprecedented negative net migration during the last three years of the decade at a time when Provincial population forecasters were predicting an annual net in-migration of 30,000 to 50,000 people. Urban municipalities in the Mid Upper area of the watershed have continued to grow due to natural increase and some in-migration. However, as the amount of net migration to the Province decreases, it cannot be expected that population growth will occur at past rates even if our share of Provincial growth increases through promotion of industrial growth. The outlook for slower but continued growth will moderate the increase of urban demands on the water resource. It will provide time to experiment with the acceptability and effectiveness of "conservation" approaches. It will also change the staging for works directly related to population growth.

The Grand River Basin Water Management Study has recommended that the alternatives be evaluated using the medium population projection. In light of recent Provincial trends this projection will be high and it is probable that a lower projection is more realistic. Use of the medium projection therefore will distort and exaggerate costs and yield unrealistically early dates for the need of new facilities. Because of the recent major change in population growth in Ontario, local population growth should be monitored closely and priorities reviewed if the trend to slower growth continues.

Given the competing priorities for use of the water resource and the changing demographic and economic situation throughout Ontario, water management objectives are difficult to state simply and to apply uniformly. Nonetheless, the Mid Upper Working Group recognized the need for a multi-purpose use of the river and the need to resolve conflicts inherent in this approach. The approach used by the Working Group generally provided that the water resource should be managed to:

(i) permit local priorities to be established and local problems to be addressed within the overall watershed objectives for water quality, water supply and flood damage reduction;

(ii) recognize the need to achieve all objectives (i.e. quality, supply and flood damage reduction) to as great an extent as possible;

(iii) consider structural and non-structural solutions or combinations of the two in trying to meet the objectives; and

(iv) recognize that unlimited resources are not available to implement solutions and that environmental, social and economic costs and benefits must be considered in seeking an optimal solution.

3.2 OBJECTIVES AND CONCERNS

General objectives were established for the Grand River Basin Water Management Study as follows: reduce flood damage, maintain an adequate water quality and provide an adequate water supply. Within these general objectives, there is a range of specific objectives. From the perspective of the Mid Upper Working Group, it is felt that all three objectives should be maximized to the extent that competing priorities and costs permit. The following section discusses the rationale for arriving at specific objectives.

3.2.1 Flood Damage Reduction

In the Mid Upper area, development has historically occurred in flood plains. The core areas of Bridgeport, Cambridge and New Hamburg have recently been subject to severe flooding. Solutions to reduce flood damage in these communities should form an important part of a management plan for the Grand River Basin. New development should not be permitted in the flood plain to avoid the necessity for future costly solutions to protect property and human life.

Storm water management would provide some reduction of flood peaks, particularly following summer and autumn storms. Storm water management practices are beginning to be introduced as urban development requirements in the Mid Upper region and we feel that trend should continue. In rural areas, the measures currently being promoted for erosion control will have the effect of reducing flood peaks and we would support a major educational effort to ensure that these are applied where required throughout the basin. Additional land or storm water management practices designed to reduce rural runoff should be developed and implemented where feasible.

Reforestation in areas not suitable for agriculture would assist in lowering surface runoff. Natural plantings along stream margins would help to reduce stream velocities and lessen damage due to erosion.

3.2.2. Water Quality

The water quality objective of the Mid Upper Working Group is to provide an adequate surface and ground water quality to meet user needs. As indicated below we do not feel that the water quality standard used in the Study (i.e. oxygen concentration of surface water) is comprehensive enough for our purposes.

In the Mid Upper Grand River Watershed, a major use of surface water is for sewage dilution although many area residents might consider the major use to be for recreation. Thus a primary problem has been the need for low flow augmentation because of nutrient enrichment and low oxygen levels downstream from sewage treatment plants which limit the recreational value of the river.

Recreation can include a range of activities from swimming, fishing or boating (i.e. direct use of the river) to viewing (i.e. indirect use). There is some question as to whether river water quality should be improved in order to support swimming and sport fishing along every reach of the river. There will be some areas of the river where this level of improvement is too costly and not required.

It can be argued that changing energy costs will affect recreation access and therefore additional recreation resources should be provided close to an urban population. However, rather than improving river swimming, it may be more cost effective to provide public swimming facilities which can be used year round within range of public transit. Private pools in backyards or as part of apartment complexes will also meet the demand for swimming. Similar questions can be raised about the need to provide water quality suitable for sport fisheries along the entire Grand River and its tributaries. Recreation fishing for children may not need to provide "sport" fish.

Boating and viewing as recreation activities require water that does not smell nor contain large amounts of weedy growth. However, these

activities can be planned along certain stretches of the river if adequate water quality cannot be achieved along the full length of the river at a reasonable cost.

In summary, the Provincial water quality objectives should generally be achieved. However, economic and social costs should be seriously considered particularly in improving water quality only for recreation.

We recognize that some downstream municipalities draw their supply of water from the Grand River and we would want water leaving the Mid Upper area to be of sufficient quality to be used for treatment as drinking water for downstream municipalities. However, most of the municipalities in the Mid Upper area get their water supply from ground water aquifers. It is extremely important that these aquifers do not become contaminated and we note that very little attention is paid to ground water quality in the reports of the Grand River Water Management Study. We think this apparent lack of concern is unjustified.

Urban and rural land use practices contribute to a degraded water quality. Urban runoff in areas of new construction contains high levels of silt because of land stripping practices. Use of road salt has become a recognized runoff contaminant. Less known are other roadway contaminants such as oil which enter the storm sewer system. In rural areas the activities associated with row crop and animal production are frequently contributors to contamination.

The easiest contaminant to handle is the one that doesn't get there in the first place. Instead of spending money on rehabilitation, it might be more cost effective to spend money to prevent pollution at the source through education, direct financing or compensation. Again, such programs would need to be site specific and not necessarily applied to the entire watershed.

3.2.3 Water Quantity

It is obvious that the objective of an adequate quantity of water must be met. However, it raises the questions of "adequate for what"? and "at what cost"? Most of the urban municipalities in the Mid Upper Grand River Watershed get their water supply from ground water sources. Such sources are finite and require special attention to ensure their preservation. It is particularly important that the demands of our urban municipalities do not threaten rural ground water supplies since farmers may have no alternative water sources. The Region of Waterloo at the present time is experimenting with ground water recharge using river water to increase the water supply for the cities of Kitchener and Waterloo. At the present time there is sufficient ground water to meet average day demand for a considerable period into the future. However, it will be more difficult to meet peak day demand. Since peak day demand is largely attributable to lawn watering and other interruptible needs it may be amenable to legislative solutions. Conservation of water to reduce average day demand could be achieved through water conservation techniques. Efforts such as those outlined above would postpone the need for additional capital works and provide a continued opportunity for growth of population and industry. The public acceptance of a conservation oriented program should be actively promoted. However, enough lead time should be provided to permit ongoing growth should the program not be as effective as anticipated.

3.3 CRITERIA FOR EVALUATING PLANS

The Working Group paid considerable attention to the criteria to be used in evaluating the management plans. While there were individual differences in approach, a consensus emerged within the group regarding the most important criteria. These were:

(i) The chosen plans should meet the three water management objectives of the Study, i.e. adequate water quality, sufficient water supply and protection from flood damage.

(ii) The water management options chosen should minimize negative social and environmental impacts. Major concerns included loss of agricultural land (particularly the most productive classes), displacement of people, adverse effects on business and industry and loss of wildlife habitat.

(iii) There should be a reasonable relationship between benefits and costs so that the objective can be achieved at a reasonable cost.

(iv) The "user pays" principle should be followed. Downstream areas should not have to bear the adverse consequences of the actions of upstream areas and vice versa.

3.4 EVALUATION OF PLANS

3.4.1 Water Quality

In the first set of management plans reviewed by the group, the options for achieving 100% of the water quality objective were: conventional and advanced sewage treatment accompanied by flow augmentation from the Everton reservoir with possible additional flow augmentation from the Montrose and/or Wallenstein reservoirs. The latter option was rejected because these reservoirs did not increase benefits in proportion to their cost. While misgivings were expressed about the environmental and social impacts of the Everton reservoir, the Working Group's priority was to achieve the water quality objectives and so they agreed that combining the Everton reservoir with advanced sewage treatment was the best option.

When the plans were revised following additional studies, it appeared that with the Everton reservoir in place only 60% of the water quality objective in the Speed River could be achieved versus 50% without it. The group felt that the 10% improvement in water quality could not

justify the costs (economic, social and environmental) of the reservoir. The decision was therefore taken that conventional sewage treatment expansion, tertiary treatment at Kitchener when required and additional advanced treatment at Guelph when required would provide acceptable surface water quality in the basin.

3.4.2 Water Supply

With the exception of one opinion in favour of a pipeline from one of the Great Lakes to the K-W area, the Working Group agreed that water supply objectives could be met by ground water (including induced infiltration and artificial recharge) and river sources. The proponent of the pipeline felt that the population projections used in the Study were low and that the unlimited supplies of water the pipeline would deliver would attract industry to the region and would also eliminate urban supply wells which are a threat to rural ground water supply. However, most of the group, while agreeing that a certain amount of industrial growth was desirable, did not feel that water supply would be a significant constraint with any of the proposed plans since generous population growth (and industrial growth) projections had been assumed.

There was discussion and general agreement on the desirability of a water conservation program as part of the policy framework for the Grand River Basin Water Management Plan. However, the group felt that the success of such a program could not be accurately predicted at this time. It was nonetheless decided that a program of water conservation should accompany implementation of the management plan. In this way, the group felt that there would not be a sudden water shortage if conservation failed to achieve its target but, if it succeeded, its benefits (i.e. postponing the need for additional water supply capacity) could easily be integrated into the updating of need and staging of projects.

3.4.3 Reduction of Flood Damage

The water management plans listed a variety of ways of reducing flood damage. These included channelization and dyking, flood proofing, various reservoirs and flood plain acquisition. The consensus of the group was that channelization and dyking gave the highest level of benefits, a 96% reduction in flood damage, for the lowest cost and minimum adverse social and environmental impacts.

3.5 RECOMMENDATIONS

The consensus of the Working Group was that Plan 1A provided the best policy framework for water management planning for the Grand River Basin. This plan achieves 100% of the water quality objective on the Grand and 50% on the Speed through expanded conventional and advanced sewage treatment, fulfills the water supply objective from ground water and river sources and reduces flood damage by 96% through channelization and dyking. In recommending this plan the group recognized that the cost of ensuring Provincial standards of water quality in the Speen River below Guelph appeared to be higher than were justifiable by the benefits.

The Working Group members generally expressed pleasure that it was possible to meet almost all of the water management objectives in the basin without construction of additional reservoirs and at reasonable cost. As pointed out earlier, however, a minority view held that the water supply objectives used by the Study Team were unrealistic because they did not project a major impetus for industrial growth in the K-W region. The member of the Working Group who took this view felt that any management plan implemented should include a pipeline from Lake Huron.

While Plan 1A received the majority support of the group it was clear from the discussions that there was concern about the general lack of consideration in the plans for certain aspects of water

management. This led to development of a number of recommendations which complement and, in our opinion, should be implemented with Plan 1A. They are:

(i) The encouragement of urban and rural storm water management works to help control flood peaks and improve water quality.

(ii) The improvement of surface water quality monitoring in the basin, particularly to include, where possible, the monitoring of toxic organics produced in upper reaches and which might impair the quality of downstream water.

(iii) The improvement of ground water quality monitoring networks to ensure early detection of ground water quality impairment. This region of the basin is very dependent on ground water resources and their loss would have a disastrous effect on any water management plan.

(iv) Introduction of a water conservation program with incentives and an educational campaign designed to minimize waste while not discouraging growth in legitimate uses for water.

(v) The review of assumptions on a regular basis (probably 5 years) in order to determine the impact on the Plan of changing population growth, water use, and runoff. Update the Plan when significant changes in trends will affect need and staging.

Finally, we have a comment on implementation. None of the plans presented refer to this aspect and it appears that we are not expected to consider it. Nevertheless, we see a veritable jungle of jurisdictions related to water management in the basin and feel real concern that this will impede the implementation of a rational plan. The Grand

River Basin Water Management Study should provide the basis on which the Provincial ministries can agree on the management priorities for individual parts of the basin and its sub-basins. This agreement should be adopted as Provincial policy by the Cabinet. Implementation should be coordinated by the Grand River Conservation Authority and be embodied in Official Plans and Zoning By-Laws. This policy framework would provide the basis on which local municipalities could develop local solutions to local water management problems.

4. MID LOWER REGION PUBLIC CONSULTATION WORKING GROUP REPORT

4. MID LOWER REGION PUBLIC CONSULTATION WORKING GROUP REPORT

4.1 MID LOWER REGION: A DESCRIPTION OF THE PHYSICAL AND HUMAN CHARACTER CHARACTERISTICS

Maximum relief in the mid lower region is about 350 feet with local relief seldom reaching 200 feet and is most commonly less than 75 feet. The greatest local relief occurs along the Grand River north of Paris where a deeply incised channel fronts the Galt Moraine. The two major physiographic features of the area are the Paris and Galt moraines which generally have a relief of less than 100 feet and the upper portions of the Haldimand clay plain and Norfolk sand plain. The Grand River enters the area north of Paris and is confined to a relatively narrow incised channel until it crosses the Galt Moraine where a rapid decrease in gradient has resulted in considerable alluvial deposits near Brantford. From Brantford into the lower basin region the gradient is less than 2 feet per mile. The main water courses entering the mid lower region besides the Grand River are the Nith River, Whiteman's Creek and Fairchild's Creek. Fairchild's Creek empties into the Grand River below Brantford in the lower basin region.

The Nith River is the most important tributary of the Grand in this area. The Nith River enters the area in the northwestermmost part of the area at an altitude of about 855 feet and flows into the Grand River over bedrock at Paris at an altitude of about 735 feet. It is a meandering stream generally deeply entrenched in glacial drift. The Nith River and Whiteman's Creek, formerly known as Horner's Creek, had their origins as glacial meltwater channels.

Within the boundaries of the mid lower region's concern, there are several significant natural areas developed and operated by the Grand River Conservation Authority. They are Pinehurst Lake and Brant Park Conservation Areas, Fairlake Game Farm which is mainly a wildlife rearing area, F.W.R. Dickson Wilderness Area and the Wrigley-Bannister Lakes area. The lakes in this area are post-glacial kettle lakes and act as water holding basins for the watershed as well as stop-over points for migrating waterfowl.

Another point of interest is the fact that this area lies in the transition zone between the Carolinian (Deciduous Forest Region) and the Alleghenian (Great Lakes-St. Lawrence Forest Region) forest zones.

Although agriculture is the dominant form of land use in the region the urban centre of Brantford depends heavily on the river for its water supply. Other communities in the area include Paris, Ayr, St. George, Burford, Drumbo, Bright, Plattsville and Princeton. These areas utilize groundwater, overburden wells, and spring collector systems to satisfy their community needs. Brantford is the only major community other than Cayuga that takes water directly from the river for urban use. It has been suggested that water supply in this region is adequate until the year 2001.

The City of Brantford, with a population of approximately 70,000 faces the hazards of flooding, the problem of water quality and no doubt supply without basin modification in the future. Formerly, the Grand was used as a power source for the woolen mills and today utilizes the water for residential, commercial, recreational and industrial use. In size, the city has an area of 3,837 ha.; of which 3,214 ha. has been organized in the following manner: residential 52.6%, commercial 4.9%, institutional 4.5%, industrial 16.0% and open space 21.7%. Brantford has separate sanitary and storm sewer systems. The storm sewer discharges to the Grand River and four other creeks. About 30% of the city drains directly to the Grand River, 35% to Fairchild's Creek, 30% to Mohawk Creek, 3% to Paper Mill Creek and 2% to D'Aubiguy Creek.

Paris and the other communities have abundant water supplies and Paris is the only community other than Brantford that has a serious flooding problem.

Because the communities of Kitchener-Waterloo, Guelph and Cambridge are growing so rapidly, more demands will be made on the basin in terms of water supply and quality. It is imperative that G.R.I.C. focus its concerns directly on how the river will influence growth economically, socially and environmentally in and around the City of Brantford in the future.

4.2 MAJOR CONCERNS AND OBJECTIVES

The Group addressed the problems of water supply, water quality and flooding.

With regard to the problem of water supply, the Group concluded that the major objective should be to provide an adequate supply of good quality water for rural, industrial, domestic and commercial uses at the lowest possible cost. It believes that the objective can best be achieved by:

1. Preserving natural holding areas, wetlands and swamps by means of zoning by-laws and legislation controlling drainage;

2. By identifying and protecting known aquifers;

3. By controlling spring runoff. This control should as much as possible be accomplished by improving existing reservoir operations, by encouraging farmers to build holding areas and source water controls and by preserving agricultural land in general;

4. By discouraging excessive use or waste of water through local enforcement on industrial water use.

Improving the consistency of water quality and flow can best be accomplished by the following means:

1. Sound agricultural management on flood plain lands and other areas;

2. By maintaining good ground water quality by, among other things, controlling waste disposal on land;

3. By improving sewage treatment plant sludge disposal;

4. By encouraging sound urban quality water management through increased storm water storage facilities, storage facilities for combined sewer overflows and proper street sweeping and by minimizing winter salting;

5. By reforestation and maintenance of wetlands;

6. By controlling industrial, commercial and institutional sources of pollution through improved primary, secondary and tertiary sewage treatment plants.

In order to minimize the magnitude and frequency of flooding and to minimize the damage caused by flooding the Group concluded that the following objectives should be considered:

1. Protect existing flood plain development;

2. Preserve natural holding areas;

3. Protect the undeveloped natural flood plain against urban development;

4. Encourage proper land management while minimizing the social and environmental impacts of projects.

4.3 WATER MANAGEMENT OBJECTIVES OF THE GRAND RIVER BASIN

The three major water management objectives for the Grand River Basin have been defined as:

a) reduce flood damages,
b) maintain an adequate quality throughout the basin,
c) provide an adequate water supply.

Much of the Group's attention, when reviewing the preliminary water management plans, was directed at ensuring these objectives would be met by any Plan it endorsed as acceptable. At the same time the Group realized that any water management strategy derived from the Grand River Basin Water Management Study (GRBWMS) would have impacts in areas not described by the three major water management objectives.

The concept, of a water management strategy having impact outside of water managment concerns, is consistent with an ecological approach to management. Such an approach recognizes that soil, water, vegetation, wildlife, air and man's activities are interrelated and dependent on each other. Thus an ecological approach to water management dictates that any management strategy be based on the integrated use of water and land resources.

The Group also concluded that there are secondary areas of concern that would be affected by water management plans; and would need to be considered when evaluating such plans. These secondary concerns include:

1. protection of fish and wildlife
2. provision of recreational opportunities
3. aesthetics
4. impact on agricultural landuse
5. maintenance of the quality of life

4.4 KEY CRITERIA USED IN EVALUATING WATER MANAGEMENT PLANS

Below is a summary list of the various key criteria the Group used in arriving at its Plan recommendations:

1. Must satisfy the mid lower region's requirements on flood damage reductions.

2. Relative benefits and costs - to achieve most for the money spent; structural alternatives are considered if trade-offs are achieved in benefits.

3. Plans must satisfy the DO criterion of 4 mg/L.

4. Prefer non-structural alternatives which cause the least disturbance to the basin.

5. Maximum utilization of the Grand River as a resource for the least amount of costs.

6. Least amount of social upheaval.

7. Should not destroy the valley by flooding it.

8. Should look further than 30-40 years ahead - long term outlook.

9. Minimum disruption to communities, present land uses, water and land habitat.

10. Preserving agricultural land use is a high priority.

11. Concern with the appearance of the water - clean water, support sewage treatment.

12. Prime importance to achieve 100% of the water supply objective.

13. Maintain water quality for fish and aquatic life, if the costs are acceptable.

14. Flood damage reduction is enormously important for Brantford.

15. Eliminate the plans which do not achieve at least 84% in flood damage reductions.

16. Number of households affected by flood plain acquisition is an important criterion.

17. Preservation of archaelogical and historical sites is important.

In summary, the plans selected were based on the extent to which they will achieve the goals of the mid lower region for the least cost and the least disturbance to the basin.

4.5 RECOMMENDATIONS

4.5.1 Introduction

The Group supported the three fundamental objectives of flood damage reduction, provision of adequate water supply and maintenance of adequate water quality. It could not, however, assign an absolute priority to the attainment of any one of them.

The Group concluded that the selected Plan should have the effect of reducing flood damage by at least 80%; should satisfy the water quality criterion of DO = 4 mg/L; and ensure the provision of a water supply of the maximum day demand of the valley population to the year 2001 (based on the "medium" projection).

In addition to satisfying these criteria, the selected Plan should attempt to ensure the preservation of agricultural land and cause the minimum disruption to existing watershed communities at the least cost commensurate with the maximum benefits.

The Group appreciated that all of the secondary objectives may not be wholly attainable and recognized that there must be "trade offs" one against the other in selecting the desirable Plan.

4.5.2 Flood Damage Reduction

The two urban communities, Paris and Brantford, in the mid lower region have traditionally been perceived as "high risk" areas when the Grand River is in flood and, as a consequence, the Group gave a high priority to the achievement of the flood damage reduction objective. The Group rejected the proposals for flood plain acquisition in the urban areas, although recognized that there are particular, small-scale, strategic urban locations in which the acquisition of lands prone to flooding may be desirable. The Group was not generally opposed to flood plain acquisition in the more rural areas concluding this was feasible because

there would be opportunities for recreational use of the lands, such as the Brant Park, or, alternatively, the lands could be leased back to farming activities.

The Group concluded that flood proofing of buildings would not achieve the desired level of reduction in flood damage, although such might be feasible for the occasional building in the more rural areas of the watershed.

Channelization and dyking appeared to offer the greatest opportunity of achieving this objective, without necessarily involving the construction of large impoundment reservoirs.

4.5.3 Water Supply

The Group unanimously rejected the Plan that provided for the construction of a water supply pipeline from Lake Erie since there seemed to be little benefit gained by the Municipalities of the mid lower region from such an undertaking, and concluded that the construction and "severance" effect of such a pipeline might well be detrimental to agricultural interests.

The Group therefore concluded that to provide ground water supplies upstream, and use the river as a source to downstream Municipalities, when alied with a water supply conservation program, stood the best chance of satisfying the Group's secondary objectives.

4.5.4 Water Quality

The Group concluded that advanced and tertiary sewage treatment in the urban municipalities should be a prime objective for attainment. The Group also recognized that effort must be exerted to ensure that measures are taken to improve water quality reaching the river from agricultural areas, including measures to reduce stream bank erosion.

4.5.5 Conclusion

Upon an examination of the various Plans against the preceeding indicated factors, the Group saw Plan 1A, Plan 1F and (with some reservations) Plan 1G as being the most likely to significantly attain the three fundamental objectives of the Water Management Study whilst, to some extent, satisfying the secondary level objectives established by the Group.

5. LOWER REGION PUBLIC CONSULTATION WORKING GROUP REPORT

5. LOWER REGION PUBLIC CONSULTATION WORKING GROUP REPORT

5.1 THE AREA

The Lower Region of the Grand River Watershed is primarily rural in character and economy. Historically, the Grand River was an important transportation linkage; however, today it is primarily used for municipal water supply and sewage disposal and for recreation. Other direct uses include farm related purposes and commercial fishing.

There are three larger urban areas along the Grand River within the Region of Haldimand-Norfolk (Caledonia, Cayuga and Dunnville) and two smaller hamlet areas (York and Port Maitland). The area exists today as a "greenbelt" between the Hamilton area and the developing industrial-urban areas in Nanticoke.

5.2 PUBLIC CONCERNS

The residents of the area who attended the public meetings and became involved in the public consultation working group were concerned about several Grand River related matters. These included: local flooding at Port Maitland, the removal of the dam at Dunnville, water quality and quantity (levels) issues (effecting recreation, wintering fish), flooding in the other urban areas and agriculturally related problems.

An over-riding concern that promoted involvement was the feeling of isolation from the Grand River decision makers. It was felt that most of the projects completed or contemplated by this study would primarily benefit areas on the upper Grand River with little or no effect, in the future, on this area. However, the public concerns noted above remained important to the group.

An overall objective that emerged early in the Working Group's efforts was that the use of the Grand River should be promoted as a recreational resource; therefore, improvements to the overall quantity and quality of water within the Grand River were the only practical solutions to local problems.

5.3 WATER MANAGEMENT OBJECTIVES

In November, 1979, the Working Group listed objectives for the three main issues of water quality, water supply and flooding. Paraphrased, these are as follows:

5.3.1 Water Supply

1. Promote domestic water supplies as alternate sources, e.g. cistern, rainwater catchbasin, ground water recharge infiltration facilities.
2. Protect source areas - head water, wetlands.
3. Improve storm water management: practices and regulations.
4. Protect surface and ground water levels by projects (e.g. dredging).
5. Protect wildlife habitats.

5.3.2 Water Quality

1. Promote alternate sources
2. Promote good agricultural practices
3. Control domestic/industrial sources of effluent with emphasis on: storm water quality, industrial runoff.
4. Promote reforestation.

5.3.3 Reduce Flood Damage

1. Promote alternate methods (to reservoirs) such as flood proofing (new construction), dredging (island clearing), dyking (with and without dams - e.g. Dunnville, Caledonia) and ice control.
2. Promote reservoir operations with the lower region in mind.

5.4 WATER MANAGEMENT PLANS

In January, 1980, the Working Group listed plans to meet the objectives previously identified.

The Working Group placed high priorities on maintenance and non-structural projects, such as improved agricultural practices, storm water management conservation efforts and public awareness.

5.5 EVALUATION OF PLANS

In April, May and June, 1980, the Working Group were presented with the preliminary water management plans and proceeded to evaluate them. In doing so, the Working Group members had regard for the objectives and plans they themselves had prepared earlier. In addition, the Working Group was specifically concerned about benefits that would accrue to the lower region. The cost effectiveness of the plans was also an important consideration.

The following plans were accepted in the first round of analysis in May, 1980 (in order of priority): 2(b), 6, 2(a), 1(a), 2(c), 9(b), 2(d) and 8.

These were selected from the standpoint of their cost effectiveness relative to the other plan and the priorities of the lower region.

The others have been rejected because of the low or non-existent effect on flooding, high cost or cost with very little resulting benefits.

5.6 FINAL SELECTION

The June, 1980 set of plans were reviewed on June 30, 1980. The revised costs and additional plans were considered.

In order of priority, the following three plans are recommended:

1 - 2B - maximizes flood protection and includes Montrose project, all with a medium range cost.

2 - 2A - comparable, less costly, but with reduced flood protection.

3 - 2C - similar benefits, with increased flood protection and higher costs (like 2B).

Note: Plans with extreme water conservation measures appear impractical at this time. Montrose appears essential to the lower region because it will regulate the flows.

5.7 CONCLUSIONS

Through its involvement in the Grand River Basin Water Management Study, the Working Group realizes the lower region's interdependence with the rest of the watershed. For example, solutions to water quality and quantity problems are dependent to a greater degree on upstream projects. Flooding is as well, however, some local projects can be undertaken to resolve local problems.

The Working Group has thus favoured plans that appear to offer the greatest overall benefit to the lower region.

Underlying the Working Group's concern with water quality and quantity issues is the long range potential of the area for recreation. Lying where it does in Ontario and between Hamilton and Nanticoke, the area has great potential as a greenbelt and waterway between these two growing areas.

The following are the Working Group's responses to the Recreation Questionnaire:

1. Has the study team identified all water based recreational activities on the lower Grand?

   There are additional private camping facilities between Cayuga and Dunnville (3-4).

2. Which activities would you want to see continued or increased? Be specific.

Boating should be increased via additional launching facilities, lock access and constant water levels.

4. What new water based activities would you like to see on the lower Grand?

Facilities accessible by the general pubbic (as opposed to private limited access facilities). For example, there are sufficient private campgrounds. Public access (road and trail) to the riverbank should be increased instead of new private facilities.

6. What percentage of the total cost for improving or creating a recreational facility would be appropriate for the lower basin residents to pay?

Paying for facilities should be according to present methods. However, no major project should be undertaken until the Caledonia dam project is paid (4-5 years).

6. PIPAG OBSERVATIONS

6. PIPAG OBSERVATIONS

6.1 PHYSICAL AND GEOGRAPHICAL CHARACTERISTICS

It is obvious to anyone who has travelled the Basin, from north to south, that the characteristics of each Region differ. This has been admirably illustrated in the introduction to each of the Regional Reports and, obviously, has played an important part in determining the concerns and objectives of each group.

6.2 SIMILARITY OF CONCENSUS

When P.I.P.A.G. met with the chairpersons of the four Working Groups in June, 1980, we quickly arrived at a unanimous decision.

P.I.P.A.G. would not attempt to summarize the four reports, but would endeavour to draw attention to similarities within each of the Reports, without detracting from the individual reports.

6.2.1 Plan Recommendations

For example, three out of four groups chose some variation of plan 1 as their first choice, the only difference between 1A and 1F being water conservation. A real concensus! Even the fourth group, at their earlier November, 1979 meeting, had listed their prime objectives, covering the three main issues of flood damage, water quality and water quantity, which generally supported this overall concensus. In January, 1980, this group also placed high priorities on maintenance and non-structural projects. It was only in their final meeting of June, 1980, that they selected a plan which included the West Montrose Dam, and this, we believe, because they saw that solution as being the only one which would supply their Region with the water quantity and quality to sustain their Water Recreational desires.

6.2.2 Local Solutions

It is generally evident that most of the groups favour adoption of local solutions wherever these would solve local problems. Most groups recommend flood plain control, channelization and dyking, storm water management, dredging or ice control in contrast to large dams or reservoirs.

6.2.3 Water Conservation

General concensus was reached that this should be introduced as soon as possible, through public, commercial and industrial education, or through adoption of the "user pay" principle, or probably a combination of both. Concern was expressed that insufficient current knowledge was available on this subject.

6.2.4 Compensation

Strong points were made relative to planned flood plain acquisition of riverbank areas, wetlands, reforestation, etc., these being acceptable solutions to water management, but that some form of compensation must be made for loss of land use as well as flood plain losses downstream.

6.2.5 Major Objectives

P.I.P.A.G. and all four groups generally agree that there is no single priority within the three main objectives:

- water quality
- water quantity and
- flood control

6.3 SALIENT POINTS

6.3.1 Flood Damage Reduction

Planned acquisition, channelization and dyking, storm water management, flood plain development control, plus any other local solutions are presented strongly in all reports. Education in land management, in both Urban and Rural communities, must also receive considerable attention.

6.3.2 Water Quality

Quality must not deteriorate, M.O.E. standards are an absolute minimum. Ground water is believed to be more significant than technical reports indicate and should receive further study. The dissolved oxygen criteria is not necessarily a useful measure, what is important is that water leaving an area is treatable for subsequent potable use.

Quality should support some recreation, but not necessarily all forms over the whole Basin.

Reservoirs can lower water quality at the site since you lose river regeneration.

6.3.3 Water Quality

Water conservation programs should be introduced as soon as possible, through education, "user-pay", etc.

The Working Groups favour ground water supply and recharge as opposed to a pipeline. Quantity is felt to be an important factor on the Lower Grand to support their desired recreational activities.

6.4 FINAL COMMENTS

6.4.1 Population Growth

Overall it is felt that, with the experience of the past few years in Ontario, the population growth may be somewhat over-stated. This should be re-examined in light of recent trends.

6.4.2 Public Access to Water

Concern was expressed that this amenity should be increased in preference to more private accesses.

6.4.3 Plan Implementation

With brevity in mind, attention is drawn to the last paragraph of the Mid Upper Region Report.

Whilst neither P.I.P.A.G. nor the Working Groups were asked to comment on this aspect, we do feel that it is a major point.

The Regional Report referred to does make the fact abundantly clear that a Provincially sponsored implementation plan be adopted as soon as possible, for the overall benefit of the Basin inhabitants, and to expedite adoption of local solutions.

6.4.4 Conclusion

We have attempted to highlight the efforts of the four Working Groups, without detracting from their individual Regional Reports. These Groups have been informed that they will be expected to comment on the working draft report when this is available, (item #6 of their "Terms of Reference").

APPENDICES

APPENDIX A

GRAND RIVER PUBLIC CONSULTATION SUB-COMMITTEE

TERMS OF REFERENCE

Using the Grand River Basin Water Management Study Plan as a general frame of reference, the Public Consultation Sub-committee was formed to carry out the following functions within the time period of the study:

1. To develop, plan, and expedite the Grand River public information and consultation program;

2. To disseminate information to basin residents and appropriate agencies regarding the details, status and findings of the study activities. Key groups of audience include elected officials, general publics, interest groups and individuals;

3. To facilitate two-way communications and interactions between public participants and study personnel;

4. To establish and maintain contacts with community groups, agencies and opinion leaders who may be interested in and involved with the study;

5. To identify and assess the concerns and values of public participants on the use and management of water and related land resources in the Grand River Basin, recognizing the possible discrepancies in views among groups. Public reactions, responses and ideas collected through the program will be integrated into the planning and evaluation processes of the Basin Study;

6. To maintain effective liaison with the study co-ordinator, sub-committees and task forces so that the public consultation component will be incorporated throughout the study program and inputs from other activities will be considered;

7. To report and relay the status and findings of the public information and consultation program to the study co-ordinator and the Study Team "core group";

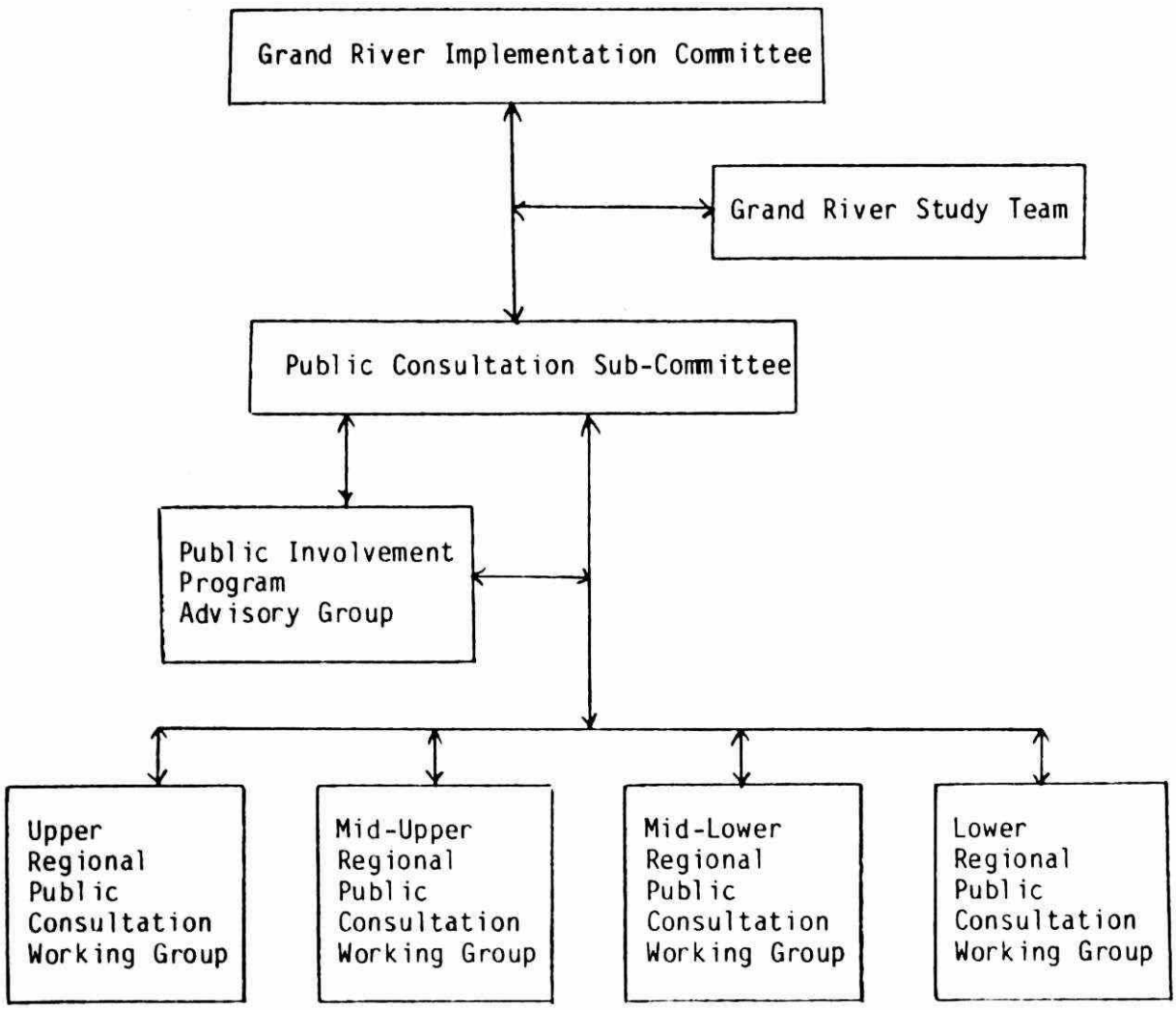
8. To prepare and submit progress reports to the Grand River Implementation Committee through the study co-ordinator; and,

9. To prepare a final report, containing the comprehensive findings of the program for submission to the Grand River Implementation Committee.

The relationship of the Public Consultation subcommittee with other subcommittees is shown in Figure A.1 Committees Involved in the Public Involvement Process.

FIGURE AI

COMMITTEES INVOLVED IN THE PUBLIC INVOLVEMENT PROCESS



APPENDIX B

PUBLIC INVOLVEMENT PROGRAM ADVISORY GROUP

Purpose

This group, comprised of seven* citizens residing in the Grand River Basin, met as an advisory body to the Public Consultation Sub-committee. Meetings were held to advise GRIC on the most effective ways to conduct a public information and involvement program for 1978-80.

Selection Process

Members of the advisory group reflected a diversity of interests and were basin residents who have shown a genuine concern about the future of water supply, water quality and streamflow management in the Grand River Basin. They have experience in public information and involvement as well as access to the communication network in the basin. The criteria used for selection were one citizen from each category as follows:

1.	Connection with agriculture	(U)**
2.	Connection with community information centres	(M)
3.	Connection with education authorities	(L)
4.	Connection with groups and associations	(U)
5.	Connection with industry	(L)
6.	Connection with media*	(General)
7.	Connection with municipal government (elected representative)	(L)
8.	Connection with urban municipal government	(M)
9.	Represenative from the GRIC Public Consultation Sub-committee	

* The group consisted originally of eight citizens, but the media representative declined the membership due to a conflict of interest.

** Denotes geographic basin portions
U = Upper M = Middle L = Lower

Terms of Reference

1. to discuss the terms of reference of the advisory group and recommend appropriate changes to the GRIC Public Consultation Sub-committee;

2. to provide input to and advise on the best ways in accomplishing a successful citizen information and involvement program;

3. to review and comment on information materials to be distributed through GRIC to the general public on an ongoing basis; and,

4. to provide feedback on the progress of the public information and consultation program and to advise appropriate changes to the program.

Membership

Mr. G. Hines, Chairman	-	Canadian Manufacturers' Association, lower basin
Mr. D. Bosomworth	-	Wellington County Federation of Agriculture, upper basin
M. S. Pennylegion	-	Guelph Information Center, middle basin
Mrs. W. Wright	-	Regional Municipality of Waterloo, middle basin
Mr. L. Davies	-	Consumers' Association of Canada, middle basin
Mr. J. Fransen	-	Haldimand Board of Education, lower basin
Mr. D. Angle	-	Regional Municipality of Haldimand-Norfolk, lower basin

APPENDIX D

PUBLIC CONSULTATION WORKING GROUPS

Terms of Reference

During the course of the Grand River Basin Water Management Study, the Public Consultation Working Groups provided a key mechanism for public input and facilitated two-way interactions and dialogue between the public and study personnel. The working groups performed an advisory role to the Grand River Implementation Committee, reporting administratively through the Public Consultation Sub-committee. Their functions were:

1. To provide input to the Grand River Basin Study on public concerns, issues and opinions on water and related land management in the Grand River Basin.

2. To react and provide input to the evaluation of alternative water resource projects and management plans, as they were developed through the study.

3. To solicit and report on briefs from interested individuals and local interest groups.

4. To review the Public Consultation Sub-committee Report and the technical reports from other sub-committees, and to suggest any changes.

5. To prepare and present the groups' reports to the Grand River Implementation Committee and the Public Consultation Sub-committee, specifically, a summay report(s) from the groups should cover a minimum items 1 through 3 listed above.

6. To review the working draft of the Grand River Basin Study Report and to suggest any changes.

Membership

Upper Region

Mrs. L. Skinner, Ayr - Chairman
Mr. J. Walker, Alma - Vice-Chairman
Mr. M. Acchione, Arthur*
Mr. S. Bowman, Elora
Mr. H. Cameron, Fergus
Mr. P. Englishman, Milverton
Mr. R. Gerson, Elmira
Mr. J. Gorrie, Kitchener
Mr. G. Landsborough, Grand Valley*
Mr. R. Marston, Elora
Mr. D. Murray, Fergus
Mr. E. Mussleman, Ariss
Mr. L. Snyder, Millbank
Mr. S. Vanderwerf, Grand Valley
Mr. P. Vanderzwaag, Grand Valley

Mid-Upper Region

Dr. J. Robinson, Guelph - Chairman
Mr. B. Dysart, Waterloo*
Mr. J. Crawley, Guelph
Mr. T. Bacigalupo, Puslinch*
Mr. G. Durnford, Guelph
Mr. B. Forwell, Kitchener
Mr. W. Fox, Waterloo
Mr. D. Hopps, Cambridge
Mr. H. Reid, Waterloo
Mr. C. Smith, Waterloo
Mr. D. Sparling, Cambridge
Mr. W. Thomson, Waterloo
Mr. M. Code, Waterloo*
Mr. R. Vles, Waterloo
Mr. T. Wagner, Guelph

* resigned from the group

Mrs. E. Waywell, Guelph
Mr. D. Howe, Cambridge
Mr. H. Ward, Cambridge

Mid-Lower Region

Mr. K. Cowell, Paris - Chairman
Mrs. M. Sheppard, Princeton - Vice-Chairman
Mr. J. Beavis, Brantford
Mr. D. Foulds, Paris
Mr. D. Kannaley, St. George
Mr. L. Millward, Paris*
Mr. P. Moores, Paris
Mr. S. Stephens, Brantford*
Mr. D. O'Regan, Brantford
Mr. R. Panter, Brantford
Mr. R. Perriman, Ayr
Mr. D. Sterrett, Brantford
Mr. J. Stratford, Brantford
Mr. C. Ward, Brantford
Dr. A. Newell, Brantford

Lower Region

Mr. J. Coughlin, Cayuga - Chairman
Mrs. K. Ayers, Dunnville - Vice-Chairman
Mr. A. Birdsell, Dunnville
Mr. R. Bruce, Cayuga
Mr. M. Doyle, Cayuga
Mr. S. Farrell, Caledonia
Mrs. E. Fuller, Caledonia
Mr. E. Gillespie, Caledonia
Mrs. D. Lang, Caledonia
Mr. B. McMaster, Caledonia
Mr. S. Parker, Dunnville
Mr. J. Vloet, Dunnville
Mr. E. Thompson, Caledonia
Mr. F. Thompson, Caledonia

* resigned from the group

APPENDIX E

WATER MANAGEMENT PLANS

Twenty-six preliminary water management plans were assembled using the projects simulated in the screening models. These plans are described briefly in the following sections (Table E.1). All references with respect to the staging of various plan components are based on a medium population projection.

Plan 1

There are nine versions to plan 1 (plan 1A to plan 1I). The same water quality projects are incorporated into all component plans except for one version, 1G. Attempts to meet water quality objectives for dissolved oxygen and ammonia nitrogen involve expansion of conventional sewage treatment plants to meet growing population needs plus advanced treatment at Kitchener immediately and at Waterloo in the year 2001. Future treatment on the Speed river will depend to a large extent upon the effectiveness of the recently installed nitrification and filtration facilities at Guelph. However, for estimating plan costs, it has been assumed that additional treatment will be required immediately and these costs have been incorporated into plan 1A. As well as improving water quality by additional sewage treatment, plan 1G incorporates a reservoir at Everton on the Eramosa river to improve water quality in the Speed river below Guelph by augmenting low, summer streamflows.

With the exception of plan 1F, water supply projects for 1 series plans are the same. Additional water supply for Kitchener-Waterloo will be provided by induced infiltration from the Grand river initiated in 1980, and recharge to the Mannheim aquifer from the Grand river in 1991. In the years 1986 and 2001, Cambridge is supplied by additional ground water extracted from Puslinch Township and North and South Dumfries Townships, respectively. Additional supplies are required from the Mannheim recharge system in 2001. Guelph water requirements will be met through further extraction of local ground water in 2011 and expansion of the Arkell recharge system in 2021. An expansion of the Brantford water treatment plant with additional extraction from the Grand river will be required by 1996. Plan 1F differs from other plans since it reduces demands through water conservation methods, thereby postponing the introduction of new water supply projects.

Methods for reducing flood damage vary among the versions of plan 1. For example, plans 1A, 1F and 1G incorporate dyking and channelization projects, whereas plan 1B utilizes a dry or single purpose reservoir at Salem on the Irvine river. Plan 1C includes flood proofing of existing floodplain structures; plan 1E suggests floodplain land acquisition, and plan 1D provides no flood damage protection.

Plan 1I is similar to plan 1A except that land required for the construction of the Montrose reservoir on the Grand river is acquired at market prices as the land becomes available. This plan allows for flexibility in the future. If future water management uncertainties are resolved and the Montrose reservoir is not required, the land can be sold on the market place.

Plan 2

There are 5 versions to plan 2 (plans 2A to 2E). Methods for flood damage reduction incorporate a reservoir at West Montrose for all plans. In plans 2A, 2B, 2C and 2D the reservoir would be multi-purpose. In plan 2E, the reservoir is used strictly for flood reduction. Additional flood control measures include dyking and channelization in plans 2B and 2C.

With the option of flow augmentation in plans 2A, 2B, 2C and 2D, recommended sewage treatment improvements outlined in the 1 series plans apply. However, advanced treatment is delayed at Kitchener and Waterloo to the years 2001 and 2021, respectively. Since no flow augmentation is available in plan 2E, all sewage treatment improvements suggested for 1 series plans are required.

The water supply options for plans 2A, 2B, 2C and 2E are the same as those outlined for plan 1A. Plan 2D differs from the others since water is supplied directly from the Montrose reservoir by pipeline. This option would be considered if water quality conditions prevented abstraction from the Grand river at Kitchener.

Plan 3

Plan 3 provides flood damage reduction through the implementation of a multi-purpose dam near Wallenstein on the Conestogo river. Improvement of water quality involves the expansion or upgrading of sewage facilities in accordance with plan 1A plus flow augmentation from the Wallenstein reservoir. Water supply options are the same as plan 1A.

Plan 4

Plan 4 is a combination of plans 1B and 3. Flood damage reduction is achieved by the implementation of a dry or single-purpose reservoir at Salem. Water quality projects include improved sewage treatment as outlined for plan 1A and flow augmentation from the Wallenstein reservoir. Water supply options are the same as plan 1A.

Plan 5

Plan 5 differs from plan 1A through the utilization of the Ayr reservoir on the Nith river for a limited amount of flood damage reduction (9 to 10 percent at Paris and Brantford) and for water supply to Kitchener, Waterloo and Cambridge.

Plan 6

Plan 6 requires the same flood damage reduction and water quality projects as plan 1A. However, additional water supply for Kitchener, Waterloo, Cambridge and Brantford is provided by a pipeline from Lake Erie. Other great lakes sources considered in the past were Georgian Bay and Lake Huron. However, pipeline schemes from these sources proved considerably more expensive than the Lake Erie option.

Plan 7

There are two versions to plan 7 (plans 7A and 7B). In both plans existing conventional sewage treatment plants are expanded but no advanced treatment is installed at the Waterloo, Kitchener and Guelph sewage treatment plants. In addition, no new flood protection is provided. While these plans are the cheapest, it would be necessary to curtail population growth because of water quality or water supply constraints.

Plan 7A immediately limits growth at Kitchener, Waterloo and Guelph because of violations in provincial water quality objectives for dissolved oxygen.

Plan 7B neglects deteriorating water quality and allows for population growth. However, water shortages become a problem limiting growth in Kitchener and Waterloo by 1991, in Cambridge by 2021 and in Brantford and Guelph by 2031. These dates could be prolonged 5 to 10 years if water conservation measures are implemented.

Plan 8

Plan 8 consists of the same water quality and water conservation projects as plan 1A. However, the effects of water conservation on the cost and staging of these projects are considered in two versions of the plan (plans 8A and 8B).

Plan 8A reduces the average and maximum day demand by 7 and 15 percent respectively, and delays the time at which water supply projects are required by 5 to 10 years. Sewage treatment expansions are also delayed by approximately 5 years.

Plan 8B reduces the average and maximum day demand by 20 and 23 percent respectively, and defers the requirement for water supply projects by an additional 5 to 15 years and sewage treatment projects by an additional 2 years. These reductions are applicable to the supply portions of any of the other plans should water conservation measures be implemented.

Reductions in flood damages for both plans are achieved by flood proofing existing floodplain structures.

Plan 9

There are two versions to plan 9 (plans 9A and 9B).

Plan 9A is the same as plan 1A with the exception of the water quality projects. Sewage treatment plants are allowed to expand. However, advanced treatment at the Waterloo, Kitchener and Guelph sewage treatment plants is not installed. Under these circumstances water quality conditions will gradually deteriorate.

Plan 9B utilizes the same water supply projects as plan 1A, but examines the case for achieving the highest water quality possible on the Grand and Speed rivers. With advanced sewage treatment at Kitchener, Waterloo and Guelph, plus flow augmentation from the Montrose and Everton reservoirs, 69 percent of the provincial water quality objective for dissolved oxygen is achieved on the Speed river and about 94 percent is achieved on the Grand river. Reductions in flood damages are provided by the Montrose dam.

Plan 10

Plan 10 is the same as plan 1A except it utilizes a single-purpose reservoir at St. Jacobs to reduce flood damages rather than dyking and channelization.

Plan 11

Plan 11 utilizes single-purpose reservoirs at Salem, St. Jacobs and Freeport and one multi-purpose reservoir at Wallenstein. The projects used for water quality and water quantity are the same as plan 1A. In addition, the Wallenstein reservoir provides flow augmentation which would improve water quality.

SUMMARY OF WATER MANAGEMENT PLANS

The twenty-six water management plans are summarized in Table E.1. For each plan the project components are described relative to the water mangement objectives, and the project costs and benefits are summarized for various discount rates. Table E.2 describes the objectives and measurements used to calculate the percentage of objective completion.

An explanation of how cost and benefits were derived in Table E.1 is discussed in Chapter 10 of the Grand River Basin Water Management Study Main Report and an explanation of the discount rate and how it pertains to the study is given in Appendix C.1 of the main report. The plans of Table E.2 have been prepared for a medium population projection. In order to determine the consequences of varying basin population growth, the basin study analyzed each plan in terms of the other population projections: the low low projection, the low projection and the high projection. The effects of these projections upon costs and benefits are described in the main Basin Study report.

TABLE E.1 SUMMARY OF PRELIMINARY WATER MANAGEMENT PLANS FOR A MEDIUM POPULATION PROJECTION
(Costs and Benefits are in Millions of 1979 Dollars)

PLAN	PLAN DESCRIPTION: WATER QUALITY	WATER SUPPLY	FLOOD PREVENTION	PRESENT VALUE OF BENEFITS & COSTS — ITEM \ DISCOUNT RATE	0%	6%	10%	NOTES
1A	Sewage Treatment: Kitchener-Nitrification Filtration 1981 Waterloo-Nitrification Filtration 2001 Guelph-Chemical Treatment and Multi-Media Filtration 1981 28% - Speed 23% - Grand	Ground Water: Guelph, Cambridge Surface Water: Kitchener-Waterloo 1991 Cambridge connect to Kitchener-Waterloo 2021 100%	Dykes & Channel Works in: Preston, Galt, Paris, Brantford, Caledonia, Dunnville, New Hamburg 91%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 77 38 0 25 1078 46 984	94 30 14 0 24 107 14 53	54 23 9 0 23 26 9 -20	
1B	Same as Plan 1A 28% - Speed 23% - Grand	Same as Plan 1A 100%	Salem Dry Reservoir 20%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 77 38 24 0 1078 10 949	94 30 14 22 0 107 3 44	54 23 9 21 0 26 2 -25	Reservoir is used for flood control only. Reservoir remains dry during non-flood periods.
1C	Same as Plan 1A 28% - Speed 23% - Grand	Same as Plan 1A 100%	Flood Proofing 20%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 77 88 0 2 1078 10 971	94 30 14 0 2 107 3 64	54 23 9 0 2 26 2 -6	Flood proofing is carried out only where economically justified (ie. Benefits ≧ Costs)
1D	Same as Plan 1A 28% - Speed 23% - Grand	Same as Plan 1A 100%	None 0%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 77 38 0 0 1078 0 963	94 30 14 0 0 107 0 63	54 23 9 0 0 26 0 -6	

Note: Percent figures refer to % of objective achieved; except where noted the objectives are: Water Quality = meet a water quality index of 0.0 on the Grand River and on the Speed River; Water Supply = Max. Day Demand; Flood Damage Reduction = zero average annual damages.

TABLE E.1 SUMMARY OF PRELIMINARY WATER MANAGEMENT PLANS FOR A MEDIUM POPULATION PROJECTION (Cont'd)
(Costs and Benefits are in Millions of 1979 Dollars)

PLAN	PLAN DESCRIPTION:			PRESENT VALUE OF BENEFITS & COSTS				NOTES
	WATER QUALITY	WATER SUPPLY	FLOOD PREVENTION	ITEM \ DISCOUNT RATE	0%	6%	10%	
1E	Same as Plan 1A 28% - Speed 23% - Grand	Same as Plan 1A 100%	Land Acquisition in Paris, Galt and Brantford to Regional Storm Flood Line 93%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 77 38 0 515 1078 43 491	94 30 14 0 486 107 13 -410	54 23 9 0 468 26 8 -466	
1F	Same as Plan 1A 28% - Speed 23% - Grand	Ground Water and Surface Water Projects same as Plan 1A Water Conservation Ave. Day reduced 7% Max. Day reduced 15% 100%	Same as Plan 1A 91%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	339 70 35 0 25 734 46 650	87 28 10 0 24 66 14 18	50 22 5 0 23 13 9 -22	Implementation date for most water supply projects deferred by 5-10 years using moderate conservation measures. STP costs in Item 1) are also reduced by water conservation.
1G	Same as Plan 1A Flow Augmentation on Speed River from Everton Reservoir 69% - Speed 23% - Grand	Same as Plan 1A 100%	Same as Plan 1A 91%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 77 38 17 25 1078 46 967	94 30 14 16 24 107 14 37	54 23 9 15 23 26 9 -35	
1H	Same as Plan 1A 28% - Speed 23% - Grand	Same as Plan 1A	Nithburg Reservoir 2%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 77 38 26 0 1078 1 938	94 30 14 24 0 107 0.3 39	54 23 9 23 0 26 0.2 29	

Note: Percent figures refer to % of objective achieved; except where noted the objectives are: Water Quality = meet a water quality index of 0.0 on the Grand River and on the Speed River; Water Supply = Max. Day Demand; Flood Damage Reduction = zero average annual damages.

TABLE E.1 SUMMARY OF PRELIMINARY WATER MANAGEMENT PLANS FOR A MEDIUM POPULATION PROJECTION (Cont'd)
(Costs and Benefits are in Millions of 1979 Dollars)

PLAN	PLAN DESCRIPTION: WATER QUALITY	WATER SUPPLY	FLOOD PREVENTION	PRESENT VALUE OF BENEFITS & COSTS — DISCOUNT RATE / ITEM	0%	6%	10%	NOTES
1I	Same as Plan 1A 28% - Speed 23% - Grand	Same as Plan 1A 100%	Dykes & Channel Works same as Plan 1A Acquire Montrose Reservoir Land for possible future use 91%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoir Land 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 77 38 0* 25 1078 46 984	94 30 14 4* 24 107 14 49	54 23 9 5* 23 26 9 -25	This version of plan assumes: - land acquisition is completed by 2001; - reservoir is not built; - land is resold in 2031.
2A	Sewage Treatment: Kitchener-Nitrification Filtration 2001 Waterloo-Nitrification Filtration 2021 Guelph-Chemical Treatment and Multi-Media Filtration 1981 Flow Augmentation: Montrose Reservoir 40% - Speed 58% - Grand	Same as Plan 1A 100%	Montrose Reservoir Dykes in New Hamburg 54%/56%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 68 38 46 1 1078 27/28** 952/953	94 17 14 42 1 107 9 42	54 10 9 41 1 26 5 -30	
2B	Same as Plan 2A Flow Augmentation Montrose Reservoir 28% - Speed 58% - Grand	Same as Plan 1A 100%	Montrose Reservoir Dykes and Channel-Works same as Plan 1A 96%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefit 8) Net Benefits = (6+7) - (2+3+4+5)	379 68 38 46 25 1078 48 949	94 17 14 42 24 107 15 25	54 10 9 41 23 26 9 -48	
2C	Same as Plan 2A Flow Augmentation Montrose Reservoir 28% - Speed 58% - Grand	Same as Plan 1A 100%	Montrose Reservoir Dykes and Channel Works (lower elevation than Plan 2B) 76%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 68 38 46 20 1078 38 944	94 17 14 42 19 107 12 27	54 10 9 41 18 26 7 -45	

Note: Percent figures refer to % of objective achieved, except where noted the objectives are: Water Quality = meet a water quality index of 0.0 on the Grand river and on the Speed river; Water Supply = Max. Day Demand; Flood Damage Reduction = zero average annual damages.

*It was assumed that the land acquired for the Montrose reservoir would be sold in the year 2001.

**A range of flood damage benefits is given for multi-purpose reservoirs. This range reflects variations in the assumed storage volume available in the spring to retain flood flows. Storage volumes will vary with the time of year and the operating rules used for each reservoir.

TABLE E.1 SUMMARY OF PRELIMINARY WATER MANAGEMENT PLANS FOR A MEDIUM POPULATION PROJECTION (Cont'd)
(Costs and Benefits are in Millions of 1979 Dollars)

PLAN	PLAN DESCRIPTION: WATER QUALITY	WATER SUPPLY	FLOOD PREVENTION	PRESENT VALUE OF BENEFITS & COSTS — ITEM \ DISCOUNT RATE	0%	6%	10%	NOTES
2D	Same as Plan 2A Flow Augmentation: Montrose Reservoir 28% - Speed 58% - Grand	Reservoir Pipeline: Kitchener, Waterloo, Cambridge Ground Water: Guelph Surface Water: Brantford 100%	Montrose Reservoir Dykes in New Hamburg 54%/56%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	367 77 111 46 0 918 27/28* 711/ 712	90 30 69 42 0 80 9 -52	53 23 62 41 0 15 5 -106	Net Benefits include savings in cost item 1). Lower costs result from reduced hydraulic STP load caused by water demand falling in response to a higher water price.
2E	Same as Plan 2A 28% - Speed 58% - Grand	Same as Plan 1A 100%	Montrose Reservoir 24.7 million cubic metres (20,000 acre feet) Dykes in New Hamburg 54%/56%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 77 38 46 1 1078 27/28* 943/ 944	94 30 14 42 1 107 9 29	54 23 9 41 1 26 5 -43	
3	Same as Plan 1A Flow Augmentation: Wallenstein Reservoir 28% - Speed 32% - Grand	Same as Plan 1A 100%	Wallenstein Reservoir Dykes in New Hamburg 20%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 77 38 36 1 1078 10 936	94 30 14 33 1 107 3 32	54 23 9 31 1 26 2 -36	
4	Same as Plan 1A Flow Augmentation: Wallenstein Reservoir 28% - Speed 32% - Grand	Same as Plan 1A 100%	Wallenstein Reservoir Salem Dry Reservoir 46%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 77 38 60 1 1078 23 925	94 30 14 55 1 107 7 14	54 23 9 53 1 26 4 -56	

Note: Percent figures refer to % of objective achieved; except where noted the objectives are: Water Quality = meet a water quality index of 0.0 on the Grand River and on the Speed River; Water Supply = Max. Day Demand; Flood Damage Reduction = zero average annual damages.

*A range of flood damage benefits is given for multi-purpose reservoirs. This range reflects variations in the assumed storage volume available in the spring to retain flood flows. Storage volumes will vary with the time of year and the operating rules used for each reservoir.

TABLE E.1 SUMMARY OF PRELIMINARY WATER MANAGEMENT PLANS FOR A MEDIUM POPULATION PROJECTION (Cont'd)
(Costs and Benefits are in Millions of 1979 Dollars)

PLAN	PLAN DESCRIPTION:			PRESENT VALUE OF BENEFITS & COSTS				NOTES
	WATER QUALITY	WATER SUPPLY	FLOOD PREVENTION	ITEM \ DISCOUNT RATE	0%	6%	10%	
5	Same as Plan 1A 28% - Speed 23% - Grand	Ayr Reservoir Pipeline: Kitchener, Waterloo, Cambridge Ground Water: Guelph 100%	Ayr Reservoir on Nith River Dykes in New Hamburg 3%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	379 77 131 40 0 894 1 647	94 30 72 36 0 76 0.4 -62	54 23 63 35 0 14 0.3 -107	
6	Same as Plan 1A 28% - Speed 23% - Grand	Lake Erie Pipeline: Brantford, Cambridge, Kitchener, Waterloo Ground Water: Guelph 100%	Same as Plan 1A 91%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	348 75 553 0 25 825 46 218	89 29 278 0 24 66 14 -251	52 22 230 0 23 9 9 -257	
7A	No new sewage treatment methods 0%	Ground Water: Cambridge Surface Water: Brantford 100% up to: 1981 - Kitchener Waterloo, Guelph 2021 - Cambridge 2031 - Brantford	None 0%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	231 0 15 0 0 127 0 -112	67 0 4 0 0 7 0 3	40 0 2 0 0 -2 0 -4	Population growth is stopped if water quality criteria are violated or if water supply capacities from conventional sources are exceeded.
7B	No new sewage treatment methods 0%	Ground Water: Kitchener, Waterloo, Cambridge, Guelph Surface Water: Brantford 100% up to: 1991 - Kitchener, Waterloo 2021 - Cambridge 2031 - Brantford, Guelph	None 0%	1) STP-CAS+Guelph RBC 2) STP-New Facilities 3) Water Supply 4) Reservoirs 5) Other Flood Prot. 6) Water Sup. Benefits 7) Flood Prot. Benefits 8) Net Benefits = (6+7) - (2+3+4+5)	310 0 26 0 0 399 0 373	82 0 8 0 0 33 0 25	47 0 4 0 0 5 0 1	Population growth is stopped if water supply capacities from conventional sources are exceeded. Water quality is not impaired.

Note: Percent figures refer to % of objective achieved, except where noted the objectives are: Water Quality = meet a water quality index of 0.0 on the Grand river and on the Speed river; Water Supply = Max. Day Demand; Flood Damage Reduction = zero average annual damages.

TABLE E.1 SUMMARY OF PRELIMINARY WATER MANAGEMENT PLANS FOR A MEDIUM POPULATION PROJECTION (Cont'd)
(Costs and Benefits are in Millions of 1979 Dollars)

PLAN	PLAN DESCRIPTION: WATER QUALITY	WATER SUPPLY	FLOOD PREVENTION	PRESENT VALUE OF BENEFITS & COSTS — ITEM \ DISCOUNT RATE	0%	6%	10%	NOTES
8A	Same as Plan 1A 28% - Speed 23% - Grand	Same as Plan 1A except demand is reduced by moderate water conservation as in Plan 1F 100%	Flood Proofing 20%	1) STP-CAS+Guelph RBC	339	87	50	Refer to notes for Plan 1F.
				2) STP-New Facilities	70	28	22	
				3) Water Supply	35	10	5	
				4) Reservoirs	0	0	0	
				5) Other Flood Prot.	2	2	2	
				6) Water Sup. Benefits	734	66	13	
				7) Flood Prot. Benefits	10	3	2	
				8) Net Benefits = (6+7) - (2+3+4+5)	637	29	-14	
8B	Same as Plan 1A 28% - Speed 23% - Grand	Ground Water: Cambridge, Guelph Surface Water: Kitchener, Waterloo Brantford Water Conservation: Ave. Day reduced 20% Max. Day reduced 23% 100%	Flood Proofing 20%	1) STP-CAS+Guelph RBC	298	79	46	Implementation date for water supply projects deferred by 10-30 years using extreme conservation measures. STP costs in Item 1) are also reduced.
				2) STP-New Facilities	63	27	21	
				3) Water Supply	30	7	3	
				4) Reservoirs	0	0	0	
				5) Other Flood Prot.	2	2	2	
				6) Water Sup. Benefits	287	18	1	
				7) Flood Prot. Benefits	10	3	2	
				8) Net Benefits = (6+7) - (2+3+4+5)	202	-15	-23	
9A	No new sewage treatment methods 0% - Speed 0% - Grand	Same as Plan 1A 100%	Same as Plan 1A 100%	1) STP-CAS+Guelph RBC	379	94	54	Water quality deteriorates with growing population.
				2) STP-New Facilities	0	0	0	
				3) Water Supply	38	14	9	
				4) Reservoirs	0	0	0	
				5) Other Flood Prot.	25	24	23	
				6) Water Sup. Benefits	1078	107	26	
				7) Flood Prot. Benefits	46	14	9	
				8) Net Benefits = (6+7) - (2+3+4+5)	1061	83	3	
9B	Sewage Treatment: Kitchener - ACA, 1981 Waterloo - Filter, 1981 Guelph - Chemical Filter, 1981 Flow Augmentation: Montrose, Everton Reservoirs 69% - Speed 90% - Grand	Same as Plan 1A 100%	Montrose Reservoir 51%/57%	1) STP-CAS+Guelph RBC	379	94	54	Best water quality on the Grand River and Speed River is achieved by this plan.
				2) STP-New Facilities	227	90	70	
				3) Water Supply	38	14	9	
				4) Reservoirs	65	59	57	
				5) Other Flood Prot.	1	1	1	
				6) Water Sup. Benefits	1078	107	26	
				7) Flood Prot. Benefits	27/28*	9	5	
				8) Net Benefits = (6+7) - (2+3+4+5)	774/775	-48	-106	

Note: Percent figures refer to % of objective achieved, except where noted the objectives are: Water Quality = meet a water quality index of 0.0 on the Grand river and on the Speed river; Water Supply = Max. Day Demand; Flood Damage Reduction = zero average annual damages.

*A range of flood damage benefits is given for multi-purpose reservoirs. This range reflects variations in the assumed storage volume available in the spring to retain flood flows. Storage volumes will vary with the time of year and the operating rules used for each reservoir.

TABLE E.1 SUMMARY OF PRELIMINARY WATER MANAGEMENT PLANS FOR A MEDIUM POPULATION PROJECTION (Cont'd)
(Costs and Benefits are in Millions of 1979 Dollars)

PLAN	PLAN DESCRIPTION:			PRESENT VALUE OF BENEFITS & COSTS				NOTES
	WATER QUALITY	WATER SUPPLY	FLOOD PREVENTION	ITEM \ DISCOUNT RATE	0%	6%	10%	
10	Same as Plan 1A	Same as Plan 1A	St. Jacobs Dry Reservoir	1) STP-CAS+Guelph RBC	379	94	54	
				2) STP-New Facilities	77	30	23	
			Dykes in New Hamburg	3) Water Supply	38	14	9	
				4) Reservoirs	26	25	24	
				5) Other Flood Prot.	1	1	1	
				6) Water Sup. Benefits	1078	107	26	
	28% - Speed			7) Flood Prot. Benefits	25/26*	8	5	
	23% - Grand	100%	49%/50%	8) Net Benefits = (6+7) - (2+3+4+5)	961/962	45	-26	
11	Same as Plan 1A	Same as Plan 1A	Wallenstein Reservoir	1) STP-CAS+Guelph RBC	379	94	54	Dry reservoirs are used for flood control only. Reservoirs remain dry during non-flood periods.
			Salem Dry Reservoir	2) STP-New Facilities	77	30	23	
			St. Jacobs Dry Reservoir	3) Water Supply	38	14	9	
			Freeport Dry Reservoir	4) Reservoirs	126	116	111	
				5) Other Flood Prot.	1	1	1	
			Dykes in New Hamburg	6) Water Sup. Benefits	1078	107	26	
	28% - Speed			7) Flood Prot. Benefits	30	9	6	
	32% - Grand	100%	61%	8) Net Benefits = (6+7) - (2+3+4+5)	866	49	112	

Note: Percent figures refer to % of objective achieved, except where noted the objectives are: Water Quality = meet a water quality index of 0.0 on the Grand river and on the Speed river; Water Supply = Max. Day Demand; Flood Damage Reduction = zero average annual damages.

*A range of flood damage benefits is given for multi-purpose reservoirs. This range reflects variations in the assumed storage volume available in the spring to retain flood flows. Storage volumes will vary with the time of year and the operating rules used for each reservoir.

Table E.2 Description of Water Management Objectives

OBJECTIVE	WATER QUALITY	WATER SUPPLY	FLOODING
DESCRIPTION	Maintain adequate dissolved oxygen levels with minimum values never falling below 4.0 mg/L.	Satisfy average and maximum day demand.	Eliminate or reduce average annual flood damages.
MEASUREMENT OF % CHANGE	% Reduction in water quality D.O. index. This index is a function of non-compliance with the provincial water quality objectives, frequency of violation in any one month and length of stream in violation.	% Satisfaction of water demand.	% Reduction in average annual damages.